09567863

09/981,344

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*** YOU HAVE NEW MAIL ***

=> s nanoparticles (4a) oligonucleotide?
L1 267 NANOPARTICLES (4A) OLIGONUCLEOTIDE?

=> s l1 and hybrization
L2 1 L1 AND HYBRIZATION

=> s l1 and hybridization
L3 151 L1 AND HYBRIDIZATION

=> s l3 and solid surface
L4 38 L3 AND SOLID SURFACE

=> dup rem l4
PROCESSING COMPLETED FOR L4
L5 35 DUP REM L4 (3 DUPLICATES REMOVED)

=> d l5 bib abs 1-35

L5 ANSWER 1 OF 35 USPATFULL
AN 2003:86172 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2003059777 A1 20030327
AI US 2001-957313 A1 20010920 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN

09567863

PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8060
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

L5 ANSWER 2 OF 35 USPATFULL
AN 2003:78438 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2003054358 A1 20030320
AI US 2001-975376 A1 20011011 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8059
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of

the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 3 OF 35 USPATFULL
AN 2003:71346 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc.
PI US 2003049631 A1 20030313
AI US 2001-974500 A1 20011010 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 172
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 6565
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise (contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto, In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles The invention further provides nanomaterials and iianostructures comprising nanoparticles and methods of nanofabrication utilizing the nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 4 OF 35 USPATFULL
AN 2003:71345 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached

thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2003049630 A1 20030313
AI US 2001-957318 A1 20010920 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8041
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 5 OF 35 USPATFULL
AN 2003:64684 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C, Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2003044805 A1 20030306
AI US 2001-981344 A1 20011015 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of

Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8061
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 6 OF 35 USPATFULL
AN 2003:30222 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Park, So-Jung, Evanston, IL, UNITED STATES
PI US 2003022169 A1 20030130
AI US 2001-820279 A1 20010328 (9)
RLI Continuation-in-part of Ser. No. US 2001-760500, filed on 12 Jan 2001, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-176409P 20000113 (60)
US 2000-200161P 20000426 (60)
US 2000-192699P 20000328 (60)
US 2000-254392P 20001208 (60)
US 2000-255235P 20001211 (60)
DT Utility
FS APPLICATION
LREP MCDONNELL BOEHNEN HULBERT & BERGHOFF, 300 SOUTH WACKER DRIVE, SUITE 3200, CHICAGO, IL, 60606
CLMN Number of Claims: 570
ECL Exemplary Claim: 1
DRWN 65 Drawing Page(s)
LN.CNT 11127
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles

having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.F

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 7 OF 35 USPATFULL
AN 2003:3422 USPATFULL
TI Bio-polymer array system with detection sensitivity enhanced by radiation treatment
IN Golovlev, Valeri, Oak Ridge, TN, UNITED STATES
PI US 2003003457 A1 20030102
AI US 2001-891421 A1 20010626 (9)
DT Utility
FS APPLICATION
LREP Valeri V. Golovlev, 107 Canterbury Rd., Oak Ridge, TN, 37830
CLMN Number of Claims: 18
ECL Exemplary Claim: 1
DRWN 12 Drawing Page(s)
LN.CNT 915
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB Devices and techniques are disclosed for sequencing, fingerprinting, or mapping bio-polymer molecules in micro-array format by tagging molecules with radiation absorbing particles and exposing tagged molecules to electromagnetic radiation such as microwave radiation. The use of radiation absorbing material for tagging enhances detection sensitivity by dissipating energy of the radiation in spots on surface where tagged molecules are located. Proposed system can be particularly beneficial when used as a reader system for DNA and protein microarrays in genomic and proteomic applications, for reading affinity assays, and for detection of a trace amount of chemical or biological species of interest on a surface.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 8 OF 35 USPATFULL
AN 2003:13189 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, United States
Letsinger, Robert L., Wilmette, IL, United States
Mucic, Robert C., Glendale, CA, United States
Storhoff, James J., Evanston, IL, United States
Elghanian, Robert, Chicago, IL, United States
Taton, Thomas A., Chicago, IL, United States
PA Nanosphere, Inc., Northbrook, IL, United States (U.S. corporation)
PI US 6506564 B1 20030114
AI US 2000-603830 20000626 (9)
RLI Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999
Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999
Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997

09567863

PRAI US 2000-200161P 20000426 (60)
US 1996-31809P 19960729 (60)
DT Utility
FS GRANTED
EXNAM Primary Examiner: Riley, Jezia
LREP McDonnell Boehnen Hulbert & Berghoff
CLMN Number of Claims: 42
ECL Exemplary Claim: 1
DRWN 84 Drawing Figure(s); 47 Drawing Page(s)
LN.CNT 5976
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 9 OF 35 WPIDS (C) 2003 THOMSON DERWENT DUPLICATE 1
AN 2003-228115 [22] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]
DNC C2003-058652
TI Detecting nucleic acids having 2 portions e.g. for detecting disease, comprises use of **nanoparticles** which have **oligonucleotides** attached to them that are complementary to portions of the nucleic acid sequence.
DC B04 D16
IN ELGHANIAN, R; LETSINGER, R L; MIRKIN, C A; MUCIC, R C; STORHOFF, J J; TATON, T A
PA (NANO-N) NANOSPHERE INC
CYC 1
PI US 2002155461 A1 20021024 (200322)* 130p
ADT US 2002155461 A1 Provisional US 1996-31809P 19960729, CIP of WO 1997-US12783 19970721, CIP of US 1999-240755 19990129, CIP of US 1999-344667 19990625, Provisional US 2000-200161P 20000426, Cont of US 2000-603830 20000626, US 2001-976378 20011012
FDT US 2002155461 A1 CIP of US 6361944
PRAI US 2001-976378 20011012; US 1996-31809P 19960729; WO 1997-US12783 19970721; US 1999-240755 19990129; US 1999-344667 19990625; US 2000-200161P 20000426; US 2000-603830 20000626
AN 2003-228115 [22] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]
AB US2002155461 A UPAB: 20030402
NOVELTY - Detecting (M1) nucleic acid (NA) having 2 portions comprises:
(a) providing a type of **nanoparticles** (NP) having **oligonucleotides** (O) attached, where (O) on each NP has a sequence

complementary to a sequence of 2 portions of NA;

(b) contacting NA and NP to allow **hybridization** of (O) on NP with two or more portions of NA; and

(c) observing a detectable change brought about by **hybridization** of (O) on NP with NA.

DETAILED DESCRIPTION - Detecting (M1) nucleic acid (NA) having 2 portions by:

(a) providing an NP (I) attached to an oligonucleotide (O), where (O) on each nanoparticle has a sequence complementary to a sequence of the 2 portions of NA;

(b) contacting NA and NP to allow **hybridization** of (O) on NP; and

(c) observing a detectable change brought about by **hybridization**.

Detecting NA having 2 portions can be by:

(i) contacting the NA with 2 types of NP attached to (O), (O) on the first type of NP having a sequence complementary to a portion of the sequence of the NA, the (O) on the second type of NP having a sequence complementary to a second portion of the sequence of the NA, the contacting taking place to allow **hybridization** of the (O) on the NP with the NA, and observing a detectable change brought about by **hybridization** of (O) on NP with the NA;

(ii) providing a substrate attached to an NP, the NP attached to (O), the (O) having a sequence complementary to a portion of the sequence of a NA to be detected, contacting the NA with the NP attached to the substrate to allow **hybridization** of the (O) on the NP with the NA, providing a second type of NP having attached oligonucleotides, (O) having a sequence complementary to other portion(s) of the sequence of the NA, contacting the NA bound to the substrate with the second type of NP to allow **hybridization** of the (O) on the second type of NP with the NA and observing a detectable change, where optionally, before carrying the detecting step, a binding oligonucleotide having a selected sequence with 2 portions is provided, the first portion being complementary to a portion of the sequence of the (O) on the second type of NP, contacting the binding oligonucleotide with the second type of NP bound to the substrate to allow **hybridization** of the binding oligonucleotide to the (O) on the NP, providing a third type of NP having attached (O), the (O) having a sequence complementary to the sequence of a second portion of the binding oligonucleotide, contacting the third type of nanoparticle with the binding oligonucleotide bound to the substrate to allow **hybridization** of the NP; or

(iii) contacting a NA to be detected with a substrate having (O) attached to it, the (O) having a sequence complementary to a portion of the sequence of the NA, the contacting taking place to allow **hybridization** of the (O) on the substrate with the NA, contacting the NA bound to the substrate with a type of NP having one or more types of (O) attached to it, one type of the oligonucleotides having a sequence complementary to a second portion of the sequence of the NA, the contacting taking place to allow **hybridization** of the (O) on the NP with the NA, contacting the first type of NP bound to the substrate with a second type of NP having (O) attached to it, the (O) on the second type of NP having a sequence complementary to a portion of the sequence of one of the types of (O) on the first type of NP, the contacting taking place to allow **hybridization** of the (O) on the first and second types of NP, and observing a detectable change.

INDEPENDENT CLAIMS are also included for the following:

(1) an aggregate probe comprising 2 types of NP attached to it;

(2) a core probe comprising 2 types of NP having (O) attached to it;

(3) a substrate attached to NP;

(4) a metallic or semiconductor NP attached to (O);

(5) kits and compositions comprising NP;

(6) nanomaterials and nanostructures comprising nanoparticles and

nanofabrication using nanoparticles;

(7) a satellite probe comprising, a particle having attached (O), the (O) having 2 portions, both portions having sequences complementary to portions of the sequence of a nucleic acid, and a probe (O) hybridized to the (O) attached to the nanoparticles, the probe (O) having 2 portions, one portion having a sequence complementary to the sequence of the first portion of the (O) attached to the particles, both portions having sequences complementary to portions of the sequence of the nucleic acid, the probe (O) having a reporter molecule attached to 1 end;

(8) an assembly of containers comprising 2 containers having attached (O);

(9) a NP (I) having several different attached (O);

(10) separating a selected NA having 2 portions from other NAs using types of NPs having attached (O);

(11) synthesizing unique NP-(O) conjugates;

(12) a NP-(O) conjugate produced by (11);

(13) using the conjugates for detecting NA having 2 portions;

(14) NP having recognition (O) attached to them;

(15) NP having (O) attached to them, the (O) comprising a type of recognition (O), each of the types of (O) comprising a sequence complementary to a portion of the sequence of a nucleic acid or another (O);

(16) a kit comprising a container holding NP-(O) conjugates and NP.

USE - (I) is useful for separating a selected nucleic acid having 2 portions, from other nucleic acids, and for detecting nucleic acids having 2 portions. NP-(O) conjugates are useful for detecting NA having 2 portions. (M1) is useful for detecting nucleic acid having 2 portions (claimed). (M1) is useful for detecting any type of nucleic acids which may be used for diagnosis of disease and in sequencing of nucleic acids. Preferably, the method is useful for detecting nucleic acids for diagnosis and/or monitoring of viral diseases (human immunodeficiency virus, hepatitis virus, herpes virus, cytomegalovirus and Epstein-Barr virus), bacterial diseases, sexually transmitted diseases, inherited disorders, in forensics, in DNA sequencing, for paternity testing, for cell line authentication, for monitoring gene therapy, etc. The method is useful in research and analytical laboratories in DNA sequencing, in the field to detect the presence of specific pathogens, etc.

ADVANTAGE - Detecting nucleic acids based on observing a color change with the naked eye is cheap, fast, simple and robust, and does not require specialized expensive equipment.

DESCRIPTION OF DRAWING(S) - The figure shows a schematic diagram illustrating formation of nanoparticle aggregates by combining nanoparticles having complementary oligonucleotides attached to them, the nanoparticles being held together in aggregates has result of the hybridization of the complementary oligonucleotides.

Dwg.1/41

L5 ANSWER 10 OF 35 WPIDS (C) 2003 THOMSON DERWENT DUPLICATE 2
AN 2003-228114 [22] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228115 [22]
DNC C2003-058651
TI Detecting nucleic acids having 2 portions e.g. for detecting disease, comprises use of **nanoparticles** which have **oligonucleotides** attached to them that are complementary to portions of the nucleic acid sequence.
DC B04 D16
IN ELGHANIAN, R; LETSINGER, R L; MIRKIN, C A; MUCIC, R C; STORHOFF, J J; TATON, T A
PA (NANO-N) NANOSPHERE INC
CYC 1

09567863

PI US 2002155459 A1 20021024 (200322)* 129p
ADT US 2002155459 A1 Provisional US 1996-31809P 19960729, CIP of WO 1997-US12783 19970721, CIP of US 1999-240755 19990129, CIP of US 1999-344667 19990625, Provisional US 2000-200161P 20000426, Cont of US 2000-603830 20000626, US 2001-975062 20011011
FDT US 2002155459 A1 CIP of US 6361944
PRAI US 2001-975062 20011011; US 1996-31809P 19960729; WO 1997-US12783 19970721; US 1999-240755 19990129; US 1999-344667 19990625; US 2000-200161P 20000426; US 2000-603830 20000626
AN 2003-228114 [22] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228115 [22]
AB US2002155459 A UPAB: 20030402
NOVELTY - Detecting (M1) nucleic acid (NA) having 2 portions comprises:
(a) providing **nanoparticles** (NP; I) having **oligonucleotides** (O) attached, where (O) on each NP has a sequence complementary to a sequence of 2 portions of NA;
(b) contacting NA and NP to allow **hybridization** of (O) on NP with two or more portions of NA; and
(c) observing a detectable change brought about by **hybridization** of (O) on NP with NA.
DETAILED DESCRIPTION - Detecting (M1) nucleic acid (NA) having 2 portions by:
(a) providing an NP (I) attached to an oligonucleotide (O), where (O) on each nanoparticle has a sequence complementary to a sequence of the 2 portions of NA;
(b) contacting NA and NP to allow **hybridization** of (O) on NP; and
(c) observing a detectable change brought about by **hybridization**.
Detecting NA having 2 portions can be by:
(i) contacting the NA with 2 types of NP attached to (O), (O) on the first type of NP having a sequence complementary to a portion of the sequence of the NA, the (O) on the second type of NP having a sequence complementary to a second portion of the sequence of the NA, the contacting taking place to allow **hybridization** of the (O) on the NP with the NA, and observing a detectable change brought about by **hybridization** of (O) on NP with the NA;
(ii) providing a substrate attached to an NP, the NP attached to (O), the (O) having a sequence complementary to a portion of the sequence of a NA to be detected, contacting the NA with the NP attached to the substrate to allow **hybridization** of the (O) on the NP with the NA, providing a second type of NP having attached oligonucleotides, (O) having a sequence complementary to other portion(s) of the sequence of the NA, contacting the NA bound to the substrate with the second type of NP to allow **hybridization** of the (O) on the second type of NP with the NA and observing a detectable change, where optionally, before carrying the detecting step, a binding oligonucleotide having a selected sequence with 2 portions is provided, the first portion being complementary to a portion of the sequence of the (O) on the second type of NP, contacting the binding oligonucleotide with the second type of NP bound to the substrate to allow **hybridization** of the binding oligonucleotide to the (O) on the NP, providing a third type of NP having attached (O), the (O) having a sequence complementary to the sequence of a second portion of the binding oligonucleotide, contacting the third type of nanoparticle with the binding oligonucleotide bound to the substrate to allow **hybridization** of the NP; or
(iii) contacting a NA to be detected with a substrate having (O) attached to it, the (O) having a sequence complementary to a portion of the sequence of the NA, the contacting taking place to allow **hybridization** of the (O) on the substrate with the NA, contacting

the NA bound to the substrate with a type of NP having one or more types of (O) attached to it, one type of the oligonucleotides having a sequence complementary to a second portion of the sequence of the NA, the contacting taking place to allow **hybridization** of the (O) on the NP with the NA, contacting the first type of NP bound to the substrate with a second type of NP having (O) attached to it, the (O) on the second type of NP having a sequence complementary to a portion of the sequence of one of the types of (O) on the first type of NP, the contacting taking place to allow **hybridization** of the (O) on the first and second types of NP, and observing a detectable change.

INDEPENDENT CLAIMS are also included for the following:

(1) an aggregate probe comprising 2 types of NP attached to it;

(2) a core probe comprising 2 types of NP having (O) attached to it;

(3) a substrate attached to NP;

(4) a metallic or semiconductor NP attached to (O);

(5) kits and compositions comprising NP;

(6) nanomaterials and nanostructures comprising nanoparticles and nanofabrication using nanoparticles;

(7) a satellite probe comprising, a particle having attached (O), the (O) having 2 portions, both portions having sequences complementary to portions of the sequence of a nucleic acid, and a probe (O) hybridized to the (O) attached to the nanoparticles, the probe (O) having 2 portions, one portion having a sequence complementary to the sequence of the first portion of the (O) attached to the particles, both portions having sequences complementary to portions of the sequence of the nucleic acid, the probe (O) having a reporter molecule attached to 1 end;

(8) an assembly of containers comprising 2 containers having attached (O);

(9) a NP (I) having several different attached (O);

(10) separating a selected NA having 2 portions from other NAs using types of NPs having attached (O);

(11) synthesizing unique NP-(O) conjugates;

(12) a NP-(O) conjugate produced by (11);

(13) using the conjugates for detecting NA having 2 portions;

(14) NP having recognition (O) attached to them;

(15) NP having (O) attached to them, the (O) comprising a type of recognition (O), each of the types of (O) comprising a sequence complementary to a portion of the sequence of a nucleic acid or another (O); and

(16) a kit comprising a container holding NP-(O) conjugates and NP.

USE - (I) is useful for separating a selected nucleic acid having 2 portions, from other nucleic acids, and for detecting nucleic acids having 2 portions. NP-(O) conjugates are useful for detecting NA having 2 portions. (M1) is useful for detecting nucleic acid having 2 portions (claimed). (M1) is useful for detecting any type of nucleic acids which may be used for diagnosis of disease and in sequencing of nucleic acids. Preferably, the method is useful for detecting nucleic acids for diagnosis and/or monitoring of viral diseases (human immunodeficiency virus, hepatitis virus, herpes virus, cytomegalovirus and Epstein-Barr virus), bacterial diseases, sexually transmitted diseases, inherited disorders, in forensics, in DNA sequencing, for paternity testing, for cell line authentication, for monitoring gene therapy, etc. The method is useful in research and analytical laboratories in DNA sequencing, in the field to detect the presence of specific pathogens, etc.

ADVANTAGE - Detecting nucleic acids based on observing a color change with the naked eye is cheap, fast, simple and robust, and does not require specialized expensive equipment.

DESCRIPTION OF DRAWING(S) - The figure shows a schematic diagram illustrating the formation of nanoparticle aggregates by combining nanoparticles having complementary oligonucleotides attached to them.

Dwg.1/41

L5 ANSWER 11 OF 35 WPIDS (C) 2003 THOMSON DERWENT DUPLICATE 3
AN 2003-174167 [17] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]
DNC C2003-045481
TI Detecting nucleic acid having two portions, by providing **nanoparticles** having **oligonucleotides** attached to it, contacting nucleic acid and nanoparticles to allow **hybridization**, and observing detectable change.
DC B04 D16
IN ELGHANIAN, R; LETSINGER, R L; MIRKIN, C A; MUCIC, R C; STORHOFF, J J; TATON, T A
PA (NANO-N) NANOSPHERE INC
CYC 1
PI US 2002146720 A1 20021010 (200317)* 132p
ADT US 2002146720 A1 Provisional US 1996-31809P 19960729, CIP of WO 1997-US12783 19970721, CIP of US 1999-240755 19990129, CIP of US 1999-344667 19990625, Provisional US 2000-200161P 20000426, Cont of US 2000-603830 20000626, US 2001-961949 20010920
FDT US 2002146720 A1 CIP of US 6361944
PRAI US 2001-961949 20010920; US 1996-31809P 19960729; WO 1997-US12783 19970721; US 1999-240755 19990129; US 1999-344667 19990625; US 2000-200161P 20000426; US 2000-603830 20000626
AN 2003-174167 [17] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]
AB US2002146720 A UPAB: 20030402
NOVELTY - Detecting (M1) nucleic acid having two portions, comprising providing **nanoparticles** having **oligonucleotides** attached to it, which has a sequence complementary to sequence of two portions of nucleic acid, contacting nucleic acid and **nanoparticles**, to allow **hybridization** of **oligonucleotides** with portions of nucleic acid, and observing a detectable change brought about by **hybridization**, is new.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(1) an aggregate probe comprising at least two types of **nanoparticles** having **oligonucleotides** attached to it, where the nanoparticles of the aggregate probe is bound to each other as a result of the **hybridization** of some of the oligonucleotides attached to them, and has oligonucleotides having attached to it which have a sequence complementary to a portion of the sequence of a nucleic acid;

(2) a core probe comprising at least two types of **nanoparticles** having **oligonucleotides** attached to it, where the nanoparticles is bound to each other as a result of **hybridization** of some of the oligonucleotides attached to it;

(3) a kit comprising a container holding a composition comprising two types of **nanoparticles** having **oligonucleotides** attached to it, where the oligonucleotides on the first type of nanoparticles has a sequence complementary to the sequence of a first portion of a nucleic acid, and the oligonucleotides on the second type of nanoparticles has a sequence complementary to the sequence of a second portion of the nucleic acid, and also comprising the core probe;

(4) a substrate having nanoparticles attached to it;

(5) a metallic or semiconductor nanoparticle having oligonucleotides attached to it, where the oligonucleotides are labeled with fluorescent molecules at the ends not attached to the nanoparticle;

(6) a satellite probe comprising a particle having oligonucleotides attached to it, and probe oligonucleotides hybridized to the

oligonucleotides attached to the **nanoparticles**, and having a first portion and a second portion, where the first portion has a sequence complementary to the sequence of the first portion of oligonucleotides attached to the particles, and both portions has sequences complementary to portions of the sequence of the nucleic acid, and the probe oligonucleotide further has a reporter molecule attached to one end;

(7) a composition comprising at least two types of **nanoparticles** having **oligonucleotides** attached to it;

(8) an assembly of containers comprising a first and second containers holding **nanoparticles** having **oligonucleotides** attached to it, which has a sequence complementary to that of the **oligonucleotides** attached to the **nanoparticles** in the containers;

(9) a nanoparticle (I) having several different oligonucleotides attached to it which comprises recognition oligonucleotides, each comprising a spacer portion designed so that it is bound to the nanoparticle, and a recognition portion having a sequence complementary to a portion of the sequence of the nucleic acid or another oligonucleotide, and optionally a type of diluent oligonucleotides;

(10) binding (M2) **oligonucleotides** to charged **nanoparticles** to produce stable nanoparticle-**oligonucleotide** conjugates;

(11) nanoparticle-**oligonucleotide** conjugates (II) which are **nanoparticles** having **oligonucleotides** attached to them which is present on the surface of the nanoparticles at a surface density sufficient so that the conjugates are stable and having a sequence complementary to a portion of the sequence of a nucleic acid or another oligonucleotide, and a covalently bound cyclic disulfide or polythiol functional group;

(12) oligonucleotides having a covalently bound cyclic disulfide or polythiol functional group that can bind to the nanoparticles;

(13) a nanoparticle conjugate for detecting an analyte, comprising **nanoparticles** having **oligonucleotides** bound to it, and oligonucleotide having bound to it a specific binding complement of an analyte having a sequence that is complementary to a portion of the **oligonucleotides** bound to the **nanoparticles** and are bound, as a result of **hybridization**, and a linker oligonucleotide having two portions;

(14) nonmaterials (III) or nanostructures composed of **nanoparticles** having **oligonucleotides** attached to it, where the **nanoparticles** are held together by **oligonucleotide** connectors;

(15) a kit for detecting an analyte, comprising a container holding (II), and optional support for observing a detectable change; and

(16) a nanomaterial produced, by providing linking oligonucleotide comprising two portions, two types of **nanoparticles** having **oligonucleotides** attached to it, and a complex comprised of streptavidin or avidin bound to two or more biotin molecules, each having an oligonucleotide bound to the biotin molecule, which has a sequence that is complementary to the second portion of the linking oligonucleotide, and contacting the first and second types of **nanoparticles**, the linking **oligonucleotides** and the complex, to allow **hybridization** of the **oligonucleotides** on the **nanoparticles** to each other and to the linking oligonucleotide and the **hybridization** of the oligonucleotide of the complexes to the linking oligonucleotides so that a desired nanomaterials or nanostructures is formed.

USE - M1, (I), (II) and the aggregate probe are useful for detecting two or more nucleic acids (from a biological source) having at least two portions, such as viral RNA, bacterial or fungal DNA, a gene associated with a disease, synthetic, or structurally-modified natural or synthetic

RNA or DNA, or a product of a polymerase chain reaction amplification. (II) is useful for preparing a nanoprobe conjugate for detecting an analyte, and for detecting a nucleic acid bound to an electrode surface. (I) and (II) are useful for fabrication, and for separating a selected nucleic acid having two portions from other nucleic acids. (I), (II) and the aggregate probe are useful for detecting an analyte (especially polyvalent analyte) in a sample. (All claimed.)

ADVANTAGE - Diagnostic assays employing (II) improve the sensitivity of the assay.

Dwg.0/41

L5 ANSWER 12 OF 35 WPIDS (C) 2003 THOMSON DERWENT
AN 2002-608256 [65] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]
DNC C2002-171859
TI Detecting nucleic acid having two portions, by providing **nanoparticles** having **oligonucleotides** attached to it, contacting nucleic acid and nanoparticles to allow **hybridization**, and observing detectable change.
DC B04 D16
IN ELGHANIAN, R; GARIMELLA, V; LETSINGER, R L; LI, Z; MIRKIN, C A; MUCIC, R C; PARK, S; STORHOFF, J J; TATON, T A
PA (NANO-N) NANOSPHERE INC; (ELGH-I) ELGHANIAN R; (GARI-I) GARIMELLA V; (LETS-I) LETSINGER R L; (LIZZ-I) LI Z; (MIRK-I) MIRKIN C A; (MUCI-I) MUCIC R C; (PARK-I) PARK S; (STOR-I) STORHOFF J J; (TATO-I) TATON T A
CYC 98
PI WO 2002046472 A2 20020613 (200265)* EN 442p
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZM ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PH PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW
AU 2002030593 A 20020618 (200266)
US 2002172953 A1 20021121 (200279)
ADT WO 2002046472 A2 WO 2001-US46418 20011207; AU 2002030593 A AU 2002-30593 20011207; US 2002172953 A1 Provisional US 1996-31809P 19960729, CIP of WO 1997-US12783 19970721, CIP of US 1999-240755 19990129, CIP of US 1999-344667 19990625, Provisional US 2000-176409P 20000113, Provisional US 2000-192699P 20000328, Provisional US 2000-200161P 20000426, CIP of US 2000-603830 20000626, Provisional US 2000-224631P 20000811, Provisional US 2000-254392P 20001208, Provisional US 2000-255235P 20001211, CIP of US 2001-760500 20010112, CIP of US 2001-820279 20010328, US 2001-927777 20010810
FDT AU 2002030593 A Based on WO 200246472; US 2002172953 A1 CIP of US 6361944
PRAI US 2001-927777 20010810; US 2000-254392P 20001208; US 2000-254418P 20001208; US 2000-255235P 20001211; US 2000-255236P 20001211; US 2001-760500 20010112; US 2001-820279 20010328; US 2001-282640P 20010409; US 1996-31809P 19960729; WO 1997-US12783 19970721; US 1999-240755 19990129; US 1999-344667 19990625; US 2000-176409P 20000113; US 2000-192699P 20000328; US 2000-200161P 20000426; US 2000-603830 20000626; US 2000-224631P 20000811
AN 2002-608256 [65] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]
AB WO 200246472 A UPAB: 20030402
NOVELTY - Detecting (M1) nucleic acid having two portions, involves providing **nanoparticles** having **oligonucleotides** attached to it, which has a sequence complementary to sequence of two

portions of nucleic acid, contacting nucleic acid and **nanoparticles**, to allow **hybridization** of **oligonucleotides** with two or more portions of nucleic acid, and observing a detectable change brought about by **hybridization**.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(1) a kit comprising a container holding a composition comprising two types of **nanoparticles** having **oligonucleotides** attached to it, where the oligonucleotides on the first type of nanoparticles has a sequence complementary to the sequence of a first portion of a nucleic acid, and the oligonucleotides on the second type of nanoparticles has a sequence complementary to the sequence of a second portion of the nucleic acid;

(2) an aggregate probe comprising at least two types of **nanoparticles** having **oligonucleotides** attached to it, where the nanoparticles of the aggregate probe is bound to each other as a result of the **hybridization** of some of the oligonucleotides attached to them, and has oligonucleotides having attached to it which have a sequence complementary to a portion of the sequence of a nucleic acid;

(3) a core probe comprising at least two types of **nanoparticles** having **oligonucleotides** attached to it, where the nanoparticles is bound to each other as a result of **hybridization** of some of the oligonucleotides attached to it;

(4) a substrate having nanoparticles attached to it;

(5) a metallic or semiconductor nanoparticle having oligonucleotides attached to it, where the oligonucleotides are labeled with fluorescent molecules at the ends not attached to the nanoparticle;

(6) a satellite probe comprising a particle having oligonucleotides attached to it, and probe oligonucleotides hybridized to the **oligonucleotides** attached to the **nanoparticles**, and having a first portion and a second portion, where the first portion has a sequence complementary to the sequence of the first portion of oligonucleotides attached to the particles, and both portions has sequences complementary to portions of the sequence of the nucleic acid, and the probe oligonucleotide further has a reporter molecule attached to one end;

(7) a composition comprising at least two types of **nanoparticles** having **oligonucleotides** attached to it;

(8) an assembly of containers comprising a first and second containers holding **nanoparticles** having **oligonucleotides** attached to it, which has a sequence complementary to that of the **oligonucleotides** attached to the **nanoparticles** in the containers;

(9) a nanoparticle (I) having several different oligonucleotides attached to it which comprises recognition oligonucleotides, each comprising a spacer portion designed so that it is bound to the nanoparticle, and a recognition portion having a sequence complementary to a portion of the sequence of the nucleic acid or another oligonucleotide, and optionally a type of diluent oligonucleotides;

(10) binding (M2) **oligonucleotides** to charged **nanoparticles** to produce stable nanoparticle-**oligonucleotide** conjugates;

(11) nanoparticle-**oligonucleotide** conjugates (II) which are **nanoparticles** having **oligonucleotides** attached to them which is present on the surface of the nanoparticles at a surface density sufficient so that the conjugates are stable and having a sequence complementary to a portion of the sequence of a nucleic acid or another oligonucleotide, and a covalently bound cyclic disulfide or polythiol functional group;

(12) oligonucleotides having a covalently bound cyclic disulfide or polythiol functional group that can bind to the nanoparticles;

(13) a nanoparticle conjugate for detecting an analyte, comprising **nanoparticles** having **oligonucleotides** bound to it, and oligonucleotide having bound to it a specific binding complement of an analyte having a sequence that is complementary to a portion of the **oligonucleotides** bound to the **nanoparticles** and are bound, as a result of **hybridization**, and a linker oligonucleotide having two portions;

(14) nonmaterials (III) or nanostructures composed of **nanoparticles** having **oligonucleotides** attached to it, where the **nanoparticles** are held together by **oligonucleotide** connectors;

(15) a kit for detecting an analyte, comprising a container holding (II), and optional support for observing a detectable change;

(16) a nanomaterial produced, by providing linking oligonucleotide comprising two portions, two types of **nanoparticles** having **oligonucleotides** attached to it, and a complex comprised of streptavidin or avidin bound to two or more biotin molecules, each having an oligonucleotide bound to the biotin molecule, which has a sequence that is complementary to the second portion of the linking oligonucleotide, and contacting the first and second types of **nanoparticles**, the linking **oligonucleotides** and the complex, to allow **hybridization** of the **oligonucleotides** on the **nanoparticles** to each other and to the linking oligonucleotide and the **hybridization** of the oligonucleotide of the complexes to the linking oligonucleotides so that a desired nanomaterials or nanostructures is formed; and

(17) accelerating movement of a nanoparticle to an electrode surface.

USE - (M1), (I), (II) and the aggregate probe are useful for detecting two or more nucleic acids (from a biological source) having at least two portions, such as viral RNA, bacterial or fungal DNA, a gene associated with a disease, synthetic, or structurally-modified natural or synthetic RNA or DNA, or a product of a polymerase chain reaction amplification. (II) is useful for preparing a nanoprobe conjugate for detecting an analyte, and for detecting a nucleic acid bound to an electrode surface. (I) and (II) are useful for fabrication, and for separating a selected nucleic acid having two portions from other nucleic acids. (I), (II) and the aggregate probe are useful for detecting an analyte (especially polyvalent analyte) in a sample (all claimed).

ADVANTAGE - Diagnostic assays employing (II) improve the sensitivity of the assay.

Dwg.0/67

L5 ANSWER 13 OF 35 WPIDS (C) 2003 THOMSON DERWENT
AN 2002-258024 [30] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]
DNC C2002-076817
TI Detecting nucleic acid, useful for diagnosis of genetic, viral or bacterial disease, comprises hybridizing **nanoparticles** with attached **oligonucleotides** to nucleic acid and detecting change brought about by **hybridization**.
DC B04 D16
IN ELGHANIAN, R; GARIMELLA, V; LETSINGER, R L; LI, Z; MIRKIN, C A; MUCIC, R C; PARK, S; STORHOFF, J J; TATON, T A
PA (NANO-N) NANOSPHERE INC
CYC 95
PI WO 2002018643 A2 20020307 (200230)* EN 329p
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR

KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW

AU 2001081248 A 20020313 (200249)

ADT WO 2002018643 A2 WO 2001-US25237 20010810; AU 2001081248 A AU 2001-81248 20010810

FDT AU 2001081248 A Based on WO 200218643

PRAI US 2001-820279 20010328; US 2000-224631P 20000811; US 2000-254392P 20001208; US 2000-255235P 20001211; US 2001-760500 20010112

AN 2002-258024 [30] WPIDS

CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2001-656926 [75]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]

AB WO 200218643 A UPAB: 20030402

NOVELTY - Detecting a nucleic acid (NA) having at least 2 portions comprising:

(a) providing **nanoparticles** (NP) with attached **oligonucleotides** (OGN), where OGN has a sequence complementary to the sequence of NA;

(b) contacting NA and NP under conditions effective to allow **hybridization** of OGN with NA; and

(c) observing a detectable change brought about by **hybridization** of OGN with NA, is new.

DETAILED DESCRIPTION - Detecting (M1) a nucleic acid (NA) having at least 2 portions comprising:

(a) providing 2 types of **nanoparticles** (NP) with attached **oligonucleotides** (OGN), where OGN on type 1 has a sequence complementary to a first portion of the sequence of NA and OGN on type 2 has a sequence complementary to a second portion of the sequence of NA;

(b) contacting NA and NP under conditions effective to allow **hybridization** of OGN with NA; and

(c) observing a detectable change brought about by **hybridization** of OGN with NA, is new.

INDEPENDENT CLAIMS are also included for the following:

(1) a kit for carrying out M1;

(2) an aggregate probe comprising at least 2 types of NP having OGN attached, bound to each other as a result of **hybridization** of OGN and OGN comprises sequence complementary to a portion of NA or a hydrophobic group attached to the NP free end;

(3) a core probe comprising at least 2 types of NP having OGN attached, bound to each other as a result of **hybridization** of OGN;

(4) a substrate having NP attached;

(5) a metallic or semiconductor NP having OGN attached, where OGN are labeled with fluorescent molecules at NP free ends;

(6) a satellite probe comprising a particle having OGN attached and probe OGN hybridized to OGN on NP;

(7) a method (M2) of nanofabrication comprising:

(a) providing a linking OGN having a selected sequence of 2 portions;

(b) providing NP having OGN attached, where OGN comprises a sequence complementary to the linking OGN; and

(c) contacting linking OGN and NP under **hybridization** conditions so that a desired nanomaterial or nanostructure is formed where NP are held together by OGN connectors;

(8) nanomaterials or nanostructures composed of NP having OGN attached, where NP are held together by OGN connectors;

(9) an assembly of containers comprising containers holding NP with OGN attached;

(10) a NP having a number of different OGN attached;

(11) separating (M3) a selected NA having 2 portions;

(12) binding (M4) OGN to charged NP to produce stable NP-OGN conjugates;

(13) NP-OGN conjugates comprising OGN attached to NP at a surface

density sufficient so that the conjugates are stable, where OGN has sequence complementary to a NA or another OGN;

(14) detecting a NA using the NP-OGN conjugates;

(15) a method of nanofabrication using the NP-OGN conjugates;

(16) separating a selected NA using the NP-OGN conjugates;

(17) NP-OGN conjugates which are NP having OGN attached, where OGN have a covalently bound cyclic disulfide functional group or polythiol functional group that can bind to NP;

(18) OGN having a covalently bound cyclic disulfide functional group or polythiol functional group that can bind NP; and

(19) detecting (M5) an analyte in a sample.

USE - The methods are useful for detecting a nucleic acid, separating a selected nucleic acid from others and methods of nanofabrication (all claimed). Detecting analytes such as nucleic acids and proteins are useful for the diagnosis of genetic, bacterial and viral diseases.

ADVANTAGE - The OGN-NP conjugates that use cyclic disulfide linkers improve the sensitivity of diagnostic assays. In particular assays using OGN-NP conjugates prepared using linkers comprising a steroid residue attached to a cyclic disulfide have been found to be approx. 10 times more sensitive than assays employing conjugates prepared using alkanethiols or acyclic disulfides as the linker. The OGN-NP conjugates are stable allowing them to be used directly in PCR solutions. Therefore conjugates added as probes to a DNA target to be PCR amplified can be carried through the 30 or 40 heating cooling cycles of the PCR and are still able to detect the amplicons without opening the tubes. Opening the tubes for addition of probes after PCR can cause serious problems through contamination of the equipment to be used for subsequent tests.

Dwg.0/64

L5 ANSWER 14 OF 35 USPATFULL
AN 2002:337329 USPATFULL
TI Bio-barcodes based on **oligonucleotide**-modified **nanoparticles**
IN Mirkin, Chad A., Willmette, IL, UNITED STATES
Park, So-Jung, Evanston, IL, UNITED STATES
Nam, Jwa-Min, Evanston, IL, UNITED STATES
PI US 2002192687 A1 20021219
AI US 2002-108211 A1 20020327 (10)
RLI Continuation-in-part of Ser. No. US 2001-820279, filed on 28 Mar 2001, PENDING
PRAI WO 2001-US10071 20010328
US 2000-192699P 20000328 (60)
US 2001-350560P 20011113 (60)
DT Utility
FS APPLICATION
LREP MCDONNELL BOEHNEN HULBERT & BERGHOFF, 300 SOUTH WACKER DRIVE, SUITE 3200, CHICAGO, IL, 60606
CLMN Number of Claims: 41
ECL Exemplary Claim: 1
DRWN 4 Drawing Page(s)
LN.CNT 2185
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The present invention relates to a screening methods, compositions, and kits for detecting for the presence or absence of one or more target analytes, e.g. proteins such as antibodies, in a sample. In particular, the present invention relates to a method that utilizes reporter oligonucleotides as biochemical barcodes for detecting multiple protein structures or other target analytes in one solution.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 15 OF 35 USPATFULL

09567863

AN 2002:322449 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2002182613 A1 20021205
AI US 2001-976971 A1 20011012 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 172
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 6563
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing the nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 16 OF 35 USPATFULL
AN 2002:322447 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2002182611 A1 20021205
AI US 2001-966491 A1 20010928 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN

09567863

PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP MCDONNELL BOEHNEN HULBERT & BERGHOFF, 300 SOUTH WACKER DRIVE, SUITE 3200, CHICAGO, IL, 60606
CLMN Number of Claims: 190
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 6646
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing the nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 17 OF 35 USPATFULL
AN 2002:307830 USPATFULL
TI Movement of biomolecule-coated nanoparticles in an electric field
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Chicago, IL, UNITED STATES
Taton, Thomas Andrew, Chicago, IL, UNITED STATES
Garimella, Viswanadham, Evanston, IL, UNITED STATES
Li, Zhi, Evanston, IL, UNITED STATES
Park, So-Jung, Evanston, IL, UNITED STATES
PI US 2002172953 A1 20021121
AI US 2001-927777 A1 20010810 (9)
RLI Continuation-in-part of Ser. No. US 2001-820279, filed on 28 Mar 2001, PENDING Continuation-in-part of Ser. No. US 2001-760500, filed on 12 Jan 2001, PENDING Continuation-in-part of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-176409P 20000113 (60)
US 2000-200161P 20000426 (60)
US 2000-192699P 20000328 (60)
US 2000-254392P 20001208 (60)
US 2000-255235P 20001211 (60)
US 2000-224631P 20000811 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 598
ECL Exemplary Claim: 1

09567863

DRWN 64 Drawing Page(s)
LN.CNT 11435
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 18 OF 35 USPATFULL
AN 2002:294562 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Chicago, IL, UNITED STATES
Taton, Thomas A., Chicago, IL, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2002164605 A1 20021107
AI US 2001-966312 A1 20010928 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP MCDONNELL BOEHNEN HULBERT & BERGHOFF, 300 SOUTH WACKER DRIVE, SUITE 3200, CHICAGO, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8066
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the

conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 19 OF 35 USPATFULL
AN 2002:287518 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas Andrew, Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2002160381 A1 20021031
AI US 2001-975498 A1 20011011 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, PENDING Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 5695
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 20 OF 35 USPATFULL
AN 2002:280028 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES

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Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas Andrew, Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2002155462 A1 20021024
AI US 2001-976577 A1 20011012 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8047
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 21 OF 35 USPATFULL
AN 2002:280024 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2002155458 A1 20021024
AI US 2001-967409 A1 20010928 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)

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DT Utility
FS APPLICATION
LREP MCDONNELL BOEHNEN HULBERT & BERGHOFF, 300 SOUTH WACKER DRIVE, SUITE 3200, CHICAGO, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8059
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 22 OF 35 USPATFULL
AN 2002:280008 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Chicago, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
Garimella, Viswanadham, Evanston, IL, UNITED STATES
Li, Zhi, Evanston, IL, UNITED STATES
PI US 2002155442 A1 20021024
AI US 2001-760500 A1 20010112 (9)
RLI Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
US 2000-176409P 20000113 (60)
US 2000-213906P 20000626 (60)
DT Utility
FS APPLICATION
LREP MCDONNELL BOEHNEN HULBERT & BERGHOFF, 300 SOUTH WACKER DRIVE, SUITE 3200, CHICAGO, IL, 60606
CLMN Number of Claims: 485
ECL Exemplary Claim: 1
DRWN 51 Drawing Page(s)
LN.CNT 8754
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the

method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 23 OF 35 USPATFULL
AN 2002:265869 USPATFULL
TI Methods and reagents for multiplexed analyte capture, surface array self-assembly, and analysis of complex biological samples
IN Natan, Michael J., Los Altos, CA, UNITED STATES
Schulman, Howard, Palo Alto, CA, UNITED STATES
PA SURROMED, INC., Mountain View, CA (U.S. corporation)
PI US 2002146745 A1 20021010
AI US 2002-115863 A1 20020403 (10)
PRAI US 2001-281228P 20010403 (60)
US 2001-281041P 20010403 (60)
DT Utility
FS APPLICATION
LREP SWANSON & BRATSCHUN L.L.C., 1745 SHEA CENTER DRIVE, SUITE 330, HIGHLANDS RANCH, CO, 80129
CLMN Number of Claims: 20
ECL Exemplary Claim: 1
DRWN 5 Drawing Page(s)
LN.CNT 1204
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB Bifunctional capture probes used for multiplexed assays consist of particles bearing analyte-binding moieties and pairing oligonucleotides, which hybridize to an array of surface-bound capture oligonucleotides. Capture probes are combined with a sample containing analytes of interest, extracted from the sample, and then exposed to the oligonucleotide array. Based on their pairing oligonucleotide sequences, the capture probes self-assemble at particular array locations. Bound analytes are then detected using a method, such as mass spectrometry, that can be directed toward particular array locations. Because any number and combination of capture probes can be employed, the method is flexible and able to detect analytes at very low concentrations. Additionally, the method provides the ease of detection associated with position-addressable arrays.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 24 OF 35 USPATFULL
AN 2002:251128 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES

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PA Nanosphere, Inc. (U.S. corporation)
PI US 2002137072 A1 20020926
AI US 2001-976617 A1 20011012 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8061
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 25 OF 35 USPATFULL
AN 2002:251127 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2002137071 A1 20020926
AI US 2001-974007 A1 20011010 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606

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CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8063
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 26 OF 35 USPATFULL
AN 2002:251126 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2002137070 A1 20020926
AI US 2001-973638 A1 20011010 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8060
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits

comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 27 OF 35 USPATFULL
AN 2002:251114 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Chicago, IL, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)
PI US 2002137058 A1 20020926
AI US 2001-923625 A1 20010807 (9)
RLI Continuation of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 105
ECL Exemplary Claim: 1
DRWN 26 Drawing Page(s)
LN.CNT 3903
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing the nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 28 OF 35 USPATFULL
AN 2002:235385 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, UNITED STATES
Letsinger, Robert L., Wilmette, IL, UNITED STATES
Mucic, Robert C., Glendale, CA, UNITED STATES
Storhoff, James J., Evanston, IL, UNITED STATES
Elghanian, Robert, Skokie, IL, UNITED STATES
Taton, Thomas A., Little Canada, MN, UNITED STATES
PA Nanosphere, Inc. (U.S. corporation)

09567863

PI US 2002127574 A1 20020912
AI US 2001-973788 A1 20011010 (9)
RLI Continuation of Ser. No. US 2000-603830, filed on 26 Jun 2000, PENDING Continuation-in-part of Ser. No. US 1999-344667, filed on 25 Jun 1999, GRANTED, Pat. No. US 6361944 Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, ABANDONED Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997, UNKNOWN
PRAI US 1996-31809P 19960729 (60)
US 2000-200161P 20000426 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 431
ECL Exemplary Claim: 1
DRWN 46 Drawing Page(s)
LN.CNT 8060
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides methods of synthesizing unique nanoparticle-oligonucleotide conjugates, the conjugates produced by the methods, and methods of using the conjugates. In addition, the invention provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 29 OF 35 USPATFULL
AN 2002:60922 USPATFULL
TI Method of detection by enhancement of silver staining
IN Letsinger, Robert L., Wilmette, IL, UNITED STATES
Garimella, Viswanadham, Evanston, IL, UNITED STATES
PI US 2002034756 A1 20020321
AI US 2001-903461 A1 20010711 (9)
PRAI US 2000-217782P 20000711 (60)
DT Utility
FS APPLICATION
LREP Emily Miao, McDonnell Boehnen Hulbert & Berghoff, 32nd Floor, 300 S. Wacker Drive, Chicago, IL, 60606
CLMN Number of Claims: 30
ECL Exemplary Claim: 1
DRWN 5 Drawing Page(s)
LN.CNT 558
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The present invention relates to a method for amplifying a detection signal by enhancing or promoting the deposition of additional silver in assay detection systems where the formation of a silver spot serves as a reporter for the presence of a target molecule, including biological polymers (e.g., proteins and nucleic acids) and small molecules.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

09567863

L5 ANSWER 30 OF 35 USPATFULL
AN 2002:332594 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, United States
Letsinger, Robert L., Wilmette, IL, United States
Mucic, Robert C., Glendale, CA, United States
Storhoff, James J., Evanston, IL, United States
Elghanian, Robert, Chicago, IL, United States
PA Nanosphere, Inc., Northbrook, IL, United States (U.S. corporation)
PI US 6495324 B1 20021217
AI US 2000-693005 20001020 (9)
RLI Division of Ser. No. US 1999-344667, filed on 25 Jun 1999
Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999
Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997
PRAI US 1996-31809P 19960729 (60)
DT Utility
FS GRANTED
EXNAM Primary Examiner: Riley, Jezia
LREP McDonnell Boehnen Hulbert & Berghoff
CLMN Number of Claims: 21
ECL Exemplary Claim: 1
DRWN 62 Drawing Figure(s); 34 Drawing Page(s)
LN.CNT 4289
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing the nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 31 OF 35 USPATFULL
AN 2002:168347 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, United States
Letsinger, Robert L., Wilmette, IL, United States
Mucic, Robert C., Glendale, CA, United States
Storhoff, James J., Evanston, IL, United States
Elghanian, Robert, Chicago, IL, United States
PA Nanosphere, Inc., Northbrook, IL, United States (U.S. corporation)
PI US 6417340 B1 20020709
AI US 2000-693352 20001020 (9)
RLI Division of Ser. No. US 1999-344667, filed on 25 Jun 1999
Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999, now abandoned Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997
PRAI US 1996-31809P 19960729 (60)
DT Utility
FS GRANTED
EXNAM Primary Examiner: Riley, Jezia
LREP McDonnell Boehnen Hulbert & Berghoff

09567863

CLMN Number of Claims: 10
ECL Exemplary Claim: 1
DRWN 58 Drawing Figure(s); 34 Drawing Page(s)
LN.CNT 4214
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing the nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 32 OF 35 USPATFULL
AN 2002:63683 USPATFULL
TI **Nanoparticles** having **oligonucleotides** attached thereto and uses therefor
IN Mirkin, Chad A., Wilmette, IL, United States
Letsinger, Robert L., Wilmette, IL, United States
Mucic, Robert C., Glendale, CA, United States
Storhoff, James J., Evanston, IL, United States
Elghanian, Robert, Chicago, IL, United States
PA Nanosphere, Inc., Northbrook, IL, United States (U.S. corporation)
PI US 6361944 B1 20020326
AI US 1999-344667 19990625 (9)
RLI Continuation-in-part of Ser. No. US 1999-240755, filed on 29 Jan 1999
Continuation-in-part of Ser. No. WO 1997-US12783, filed on 21 Jul 1997
PRAI US 1996-31809P 19960729 (60)
DT Utility
FS GRANTED
EXNAM Primary Examiner: Riley, Jezia
LREP McDonnell Boehnen Hulbert & Berghoff
CLMN Number of Claims: 12
ECL Exemplary Claim: 1
DRWN 58 Drawing Figure(s); 34 Drawing Page(s)
LN.CNT 4158
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The invention provides methods of detecting a nucleic acid. The methods comprise contacting the nucleic acid with one or more types of particles having oligonucleotides attached thereto. In one embodiment of the method, the **oligonucleotides** are attached to **nanoparticles** and have sequences complementary to portions of the sequence of the nucleic acid. A detectable change (preferably a color change) is brought about as a result of the **hybridization** of the **oligonucleotides** on the **nanoparticles** to the nucleic acid. The invention also provides compositions and kits comprising particles. The invention further provides nanomaterials and nanostructures comprising nanoparticles and methods of nanofabrication utilizing the nanoparticles. Finally, the invention provides a method of separating a selected nucleic acid from other nucleic acids.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L5 ANSWER 33 OF 35 WPIDS (C) 2003 THOMSON DERWENT

09567863

AN 2001-656926 [75] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]
DNC C2001-193282
TI Detecting and separating nucleic acid, useful e.g. for diagnosis, comprises reaction with **nanoparticles** that carry **oligonucleotides** complementary to parts of the target.
DC B04 D16
IN LETSINGER, R L; MIRKIN, C A; PARK, S; ELGHANIAN, R; LI, Z; MUCIC, R C; STORHOFF, J J; TATON, T A
PA (NANO-N) NANOSPHERE INC; (LETS-I) LETSINGER R L; (MIRK-I) MIRKIN C A; (PARK-I) PARK S
CYC 94
PI WO 2001073123 A2 20011004 (200175)* EN 404p
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW
AU 2001055203 A 20011008 (200208)
US 2003022169 A1 20030130 (200311)
ADT WO 2001073123 A2 WO 2001-US10071 20010328; AU 2001055203 A AU 2001-55203 20010328; US 2003022169 A1 Provisional US 1996-31809P 19960729, CIP of WO 1997-US12783 19970721, CIP of US 1999-240755 19990129, CIP of US 1999-344667 19990625, Provisional US 2000-176409P 20000113, Provisional US 2000-192699P 20000328, Provisional US 2000-200161P 20000426, Provisional US 2000-254392P 20001208, Provisional US 2000-255235P 20001211, CIP of US 2001-760500 20010112, US 2001-820279 20010328
FDT AU 2001055203 A Based on WO 200173123; US 2003022169 A1 CIP of US 6361944
PRAI US 2001-820279 20010328; US 2000-192699P 20000328; US 2000-200161P 20000426; US 2000-213906P 20000626; US 2000-603830 20000626; US 2000-254392P 20001208; US 2000-255235P 20001211; US 2001-760500 20010112; US 1996-31809P 19960729; WO 1997-US12783 19970721; US 1999-240755 19990129; US 1999-344667 19990625; US 2000-176409P 20000113
AN 2001-656926 [75] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-451868 [48]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]
AB WO 200173123 A UPAB: 20030402
NOVELTY - Detection of nucleic acid (I) having at least 2 portions, comprising treatment with **nanoparticles** (NP) that carry **oligonucleotides** (ON) complementary to at least 2 parts of (I), where detectable change caused by **hybridization** of ON to (I) is observed, is new.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(a) similar methods using at least 2 types of NP having different ON complementary to different parts of (I);

(b) many similar methods in which (some) NP or ON are attached to a substrate, some ON are bound to liposomes, some NP are used as aggregate probes or core probes and/or particles other than NP are used;

(c) kits for performing the new methods;

(d) aggregate probes (AP) or core probes (CP) comprising at least 2 types of ON-carrying NP, connected by **hybridization** of some ON;

(e) substrate with NP attached to it;

(f) metallic or semiconductor NP carrying ON that are labeled with fluorescent molecules at the free end;

(g) satellite probe (SP) comprising particles with attached ON that

(i) are complementary to 2 parts of (I); and

(ii) hybridize to particular ON;
(h) methods of nanofabrication by linking (hybridizing) ON and NP;
(i) nanomaterials and nanostructures comprising NP with attached ON, held together by ON connectors;
(j) composition of at least 2 types of NP with ON attached; (j) set of containers for holding different types of ON-derivatized NP; (k) NP with many different ON attached;
(k) similar methods for separating or binding specific (I);
(l) methods for binding ON to NP, optionally charged, to produce conjugates;
(m) conjugates produced by method (m);
(n) method for detecting, separating and binding (I), and methods of nanofabrication, using the conjugates of (m);
(o) nanomaterials and nanostructures consisting of the conjugates of (m);
(p) methods for detecting analytes (not limited to (I)) using the conjugates of (m); and
(q) aggregate probes and kits for method (q).
The specification includes 571 claims.
USE - The method is used to detect (or to separate) specific (I), e.g. for diagnosing a wide variety of diseases, sequencing, in forensic analysis etc., also generally to detect analytes other than (I). The ON-derivatized NP are also useful for preparing nanostructures, useful e.g. as biochips, biofilters, mechanical devices, separation membranes, chemical sensors, in computers, for drug delivery etc.
ADVANTAGE - Very stable NP-ON conjugates can be produced, allowing their direct use (as probes) in polymerase chain reaction, i.e. they survive multiple heating/cooling cycles so do not need to be added after amplification. (I) are detected by simple color change, without the need for special equipment, making possible rapid field testing for e.g. pathogens.
Dwg.0/63

L5 ANSWER 34 OF 35 WPIDS (C) 2003 THOMSON DERWENT
AN 2001-451868 [48] WPIDS
CR 1998-145263 [13]; 2001-061976 [07]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]
DNC C2001-136537
TI Detecting a nucleic acid useful in e.g. diagnosing genetic, bacterial or viral diseases, by contacting the nucleic acid with **oligonucleotides** attached to **nanoparticles** and having sequences complementary a portion of the nucleic acid.
DC B04 D16
IN ELGHANIAN, R; LETSINGER, R L; MIRKIN, C A; MUCIC, R C; STORHOFF, J J; TATON, T A; GARIMELLA, V; LI, Z
PA (NANO-N) NANOSPHERE INC; (ELGH-I) ELGHANIAN R; (GARI-I) GARIMELLA V; (LETS-I) LETSINGER R L; (LIZZ-I) LI Z; (MIRK-I) MIRKIN C A; (MUCI-I) MUCIC R C; (STOR-I) STORHOFF J J; (TATO-I) TATON T A
CYC 94
PI WO 2001051665 A2 20010719 (200148)* EN 229p
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW
AU 2001032795 A 20010724 (200166)
US 2002127574 A1 20020912 (200262)
US 2002155442 A1 20021024 (200277)
US 6506564 B1 20030114 (200313)
ADT WO 2001051665 A2 WO 2001-US1190 20010112; AU 2001032795 A AU 2001-32795

20010112; US 2002127574 A1 Provisional US 1996-31809P 19960729, CIP of WO 1997-US12783 19970721, CIP of US 1999-240755 19990129, CIP of US 1999-344667 19990625, Provisional US 2000-200161P 20000426, Cont of US 2000-603830 20000626, US 2001-973788 20011010; US 2002155442 A1 Provisional US 1996-31809P 19960729, CIP of WO 1997-US12783 19970721, CIP of US 1999-240755 19990129, CIP of US 1999-344667 19990625, Provisional US 2000-176409P 20000113, Provisional US 2000-200161P 20000426, Provisional US 2000-213906P 20000626, US 2001-760500 20010112; US 6506564 B1 Provisional US 1996-31809P 19960729, CIP of WO 1997-US12783 19970721, CIP of US 1999-240755 19990129, CIP of US 1999-344667 19990625, Provisional US 2000-200161P 20000426, US 2000-603830 20000626

FDT AU 2001032795 A Based on WO 200151665; US 2002127574 A1 CIP of US 6361944; US 2002155442 A1 CIP of US 6361944

PRAI US 2001-760500 20010112; US 2000-176409P 20000113; US 2000-200161P 20000426; US 2000-603830 20000626; US 1996-31809P 19960729; WO 1997-US12783 19970721; US 1999-240755 19990129; US 1999-344667 19990625; US 2001-973788 20011010; US 2000-213906P 20000626

AN 2001-451868 [48] WPIDS

CR 1998-145263 [13]; 2001-061976 [07]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]

AB WO 200151665 A UPAB: 20030402

NOVELTY - Detecting a nucleic acid having at least 2 portions, comprises contacting the nucleic acid with one or more types of **nanoparticles** having **oligonucleotides** attached to the **nanoparticles** and having sequences complementary to portions of the sequence of the nucleic acid.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(1) methods of detecting a nucleic acid having at least 2 portions comprising:

(a) contacting the nucleic acid with one or more types of **nanoparticles** having **oligonucleotides** attached to the **nanoparticles** and having sequences complementary to portions of the sequence of the nucleic acid, under conditions allowing the **hybridization** of the **oligonucleotides** on the **nanoparticles** with the nucleic acid; and

(b) observing a detectable change brought about by **hybridization** of the **oligonucleotides** on the **nanoparticles** with the nucleic acid;

(2) kits comprising at least one container holding a composition containing at least 2 types of **nanoparticles** having **oligonucleotides** attached to it, where the first type has a sequence complementary to the sequence of a first portion of a nucleic acid, and the oligonucleotides on the second type of nanoparticles has a sequence complementary to the sequence of a second portion of the nucleic acid;

(3) an aggregate probe comprising at least 2 types of **nanoparticles** having **oligonucleotides** attached to it, the **nanoparticles** of the aggregate probe are bound to each other as a result of the **hybridization** of some of the oligonucleotides attached to them, and at least one of the nanoparticles of the aggregate probe having oligonucleotides attached to it which have a hydrophobic group on the end not attached to the nanoparticles;

(4) a kit comprising a container holding a core probe having at least 2 types of **nanoparticles** having **oligonucleotides** attached to it and the nanoparticles of the core probe is bound to each other as a result of the **hybridization** of some of the oligonucleotides attached to them;

(5) a core probe comprising at least 2 types of **nanoparticles** having **oligonucleotides** attached to it;

(6) a substrate having nanoparticles attached to it;

(7) a metallic or semiconductor nanoparticle having oligonucleotides attached to it which are labeled with fluorescent molecule at the end not attached to the nanoparticle;

(8) a satellite probe comprising a particle having attached oligonucleotides, and probe oligonucleotides hybridized to the **oligonucleotides** attached to the **nanoparticles**;

(9) methods of nanofabrication;

(10) nanomaterials or nanostructures composed of **nanoparticles** having **oligonucleotides** attached to it and being held by oligonucleotide connectors;

(11) a composition comprising at least 2 types of **nanoparticles** having **oligonucleotides** attached to it;

(12) an assembly of containers holding **nanoparticles** having **oligonucleotides** attached to them;

(13) a nanoparticle having multiple oligonucleotides attached to it;

(14) a method of separating a selected nucleic acid having at least 2 portions from other nucleic acid;

(15) methods of binding **oligonucleotides** to charged **nanoparticles** to produce stable nanoparticle-**oligonucleotide** conjugates;

(16) nanoparticle-**oligonucleotide** conjugates which are **nanoparticles** having **oligonucleotides** attached to them, where the oligonucleotides are present on the surface of the nanoparticles at a surface density sufficient so that the conjugates are stable, and at least some of the oligonucleotides have sequences complementary to at least one portion of the nucleic acid or oligonucleotide sequence;

(17) **nanoparticles** having **oligonucleotides** attached to them which comprises at least one type of recognition oligonucleotides having a sequence complementary to a portion of the nucleic acid sequence, and a type of diluent oligonucleotides; and

(18) methods of detecting a nucleic acid.

USE - The methods are useful for detecting nucleic acids, natural or synthetic, and modified or unmodified. The methods may also be applied in the diagnosis of genetic, bacterial and viral diseases, in forensics, in DNA sequencing, for paternity testing, for cell line authentication, and for monitoring gene therapy. The methods are further useful in research and analytical laboratories in DNA sequencing, in the field to detect the presence of specific pathogens, for quick identification of an infection to assist in drug prescription, and in homes and health centers for inexpensive first-line screening.

ADVANTAGE - The methods, which are based on observing color change with the naked eye, are cheap, fast, simple, robust (reagents are stable), do not require specialized or expensive equipment, and little or no instrumentation is required.

Dwg.0/46

L5 ANSWER 35 OF 35 WPIDS (C) 2003 THOMSON DERWENT
AN 2001-061976 [07] WPIDS
CR 1998-145263 [13]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]
DNC C2001-017349
TI Detecting nucleic acid, useful for e.g. diagnosis of diseases, forensics and DNA sequencing, comprises observing detectable change brought about by **hybridization** of nucleic acid with substrate or particle bound oligonucleotides.
DC B04 D16
IN ELGHANIAN, R; LETSINGER, R L; MIRKIN, C A; MUCIC, R C; STORHOFF, J J; TATON, T A
PA (ELGH-I) ELGHANIAN R; (LETS-I) LETSINGER R L; (MIRK-I) MIRKIN C A; (MUCI-I) MUCIC R C; (STOR-I) STORHOFF J J; (TATO-I) TATON T A
CYC 94

09567863

PI WO 2001000876 A1 20010104 (200107)* EN 139p
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TZ UG ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW
AU 2000056378 A 20010131 (200124)
EP 1198591 A1 20020424 (200235) EN
R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI
JP 2003503699 W 20030128 (200309) 232p

ADT WO 2001000876 A1 WO 2000-US17507 20000626; AU 2000056378 A AU 2000-56378 20000626; EP 1198591 A1 EP 2000-941713 20000626, WO 2000-US17507 20000626; JP 2003503699 W WO 2000-US17507 20000626, JP 2001-506866 20000626

FDT AU 2000056378 A Based on WO 200100876; EP 1198591 A1 Based on WO 200100876; JP 2003503699 W Based on WO 200100876

PRAI US 2000-200161P 20000426; US 1999-344667 19990625

AN 2001-061976 [07] WPIDS

CR 1998-145263 [13]; 2001-451868 [48]; 2001-656926 [75]; 2002-258024 [30]; 2002-608256 [65]; 2003-092900 [08]; 2003-174167 [17]; 2003-182627 [18]; 2003-198491 [19]; 2003-228114 [22]; 2003-228115 [22]

AB WO 200100876 A UPAB: 20030402

NOVELTY - Detecting a nucleic acid with at least 2 portions (NA) comprising hybridizing the NA with oligonucleotides attached to a substrate and/or particle and detecting a change in color, conductivity or optical density, is new.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(1) an aggregate probe (I) containing at least 2 types of containing at least 2 types of NP with attached ON that have a sequence complementary to a portion of the NA sequence;

(2) an aggregate probe (II) containing at least 2 types of containing at least 2 types of NP with attached ON that have a hydrophobic group attached to the end;

(3) a core probe (III) containing at least 2 types of NP with attached ON, where the NP are bound together as a result of the **hybridization** of the ON attached to them;

(4) detecting (M1) NA comprising:

(a) hybridizing NA with a substrate attached to ON located between a pair of electrodes, which have a sequence complementary to portion 1 of the NA;

(b) hybridizing the substrate bound NA with an aggregate probe which contains nanoparticles (NP) that conduct electricity and have at least one of the types of ON attached that have a sequence complementary to portion 2; and

(c) detecting a change in conductivity;

(5) detecting (M2) NA comprising:

(a) hybridizing

(i) a substrate attached to ON;

(ii) (I) or (II) containing at least 2 types of NP with attached ON that have a sequence complementary to portion 1 of the NA; and

(iii) a type of NP having at least 2 types of attached ON where the first has a sequence complementary to portion 2 of the NA and the second type has a sequence complementary to a portion of the ON sequence attached to the substrate; and

(b) observing a detectable change;

(6) detecting (M3) NA comprising:

(a) hybridizing NA with a substrate attached to ON;

(b) hybridizing the substrate bound NA with liposomes (LP) with attached ON having a sequence complementary to a portion of the NA sequence;

(c) hybridizing the LP bound to substrate with (II); and
(d) observing detectable change;
(7) detecting (M4) NA comprising:
(a) hybridizing:
(i) a substrate attached to ON;
(ii) (III) containing at least 2 types of NP with attached ON that have a sequence complementary to portion 1 of the NA; and
(iii) a type of linking oligonucleotide containing a sequence complementary to portion 2 of NA and a sequence complementary to a portion of the ON sequence attached to the NP of (III); and
(b) observing a detectable change;
(8) binding (M5) ON to charged NP to produce stable NP-ON conjugates which have ON at a surface density of at least 10 picomoles/cm2 on the NP surface comprising:
(a) providing ON covalently bound to a moiety containing a functional group which can bind to the NP;
(b) contacting the ON and the NP in salt water where the ionic strength is sufficient to partially overcome the electrostatic attraction or repulsion of the ON for each other or for the NP; and
(c) allow sufficient ON to bind to the NP to produce the NP-ON conjugates;
(9) NP-ON conjugates (IV) which have ON at a surface density of at least 10 picomoles/cm2 on the NP surface;
(10) detecting (M6) NA comprising:
(a) hybridizing NA with at least 1 type of (IV) having the first type with a sequence complementary to portion 1 of NA and the second type having a sequence complementary to portion 2 of NA; and
(b) observing a detectable change brought about by the hybridization of the ON on the NP with NA;
(11) detecting (M7) NA comprising:
(a) hybridizing substrate bound NA with (IV) having a sequence complementary to portion 2 of NA; and
(b) observing a detectable change;
(12) detecting (M8) NA on a substrate comprising detecting the presence and/or quantity of NA with an optical scanner;
(13) nanofabrication (M9) comprising hybridizing at least one type of linking ON having at least 2 portions and one or more types of (IV) having a sequence complementary to a portion of a linking ON, to produce a nanomaterial or nanostructure where the NP of (IV) are held together by ON connectors;
(14) nanofabrication (M10.) comprising hybridizing 2 types of (IV) where the ON of the first type of (IV) have a sequence complementary to the ON of the second type of (IV), to produce a nanomaterial of nanostructure;
(15) nanomaterials or nanostructures (V) composed of (IV) held together by ON connectors;
(16) separating a selected NA having at least 2 portions from other NA comprising hybridizing NA with 2 or more types of (IV) where the ON of (IV) have a sequence complementary to a portion of the selected NA, so that (IV) hybridized with the selected NA aggregate and precipitate; and
(17) kits for detecting nucleic acids.

USE - The new methods are useful for detecting nucleic acids, such as, for the diagnosis and/or monitoring of diseases (e.g. viral diseases, bacterial diseases, sexually transmitted diseases, inherited disorders and cancers), in forensics, in DNA sequencing, for paternity testing, for cell line authentication and for monitoring gene therapy.

ADVANTAGE - Detecting nucleic acids based upon observing a color change, e.g. with the naked eye, is cheap, fast, simple, robust as the reagents are stable, do not require specialized or expensive equipment, and little or no instrumentation is required. The nanoparticle oligonucleotide conjugates remain stable for at least 6 months. They are also highly selective and specific as the temperature range over which

they form is quite narrow. A single base mismatch and as little as 20 femtomoles (fM) of target can be detected using the conjugates. This points towards a potential method for detecting oligonucleotide targets without the need for target amplification schemes such as polymerase chain reaction.

To evaluate the effectiveness of nanoparticles as colorimetric indicators for oligonucleotide arrays, test chips were probed with a synthetic target and labeled with both fluorophore and nanoparticle indicators. Arrays challenged with the model target and nanoparticle labeled probes and stained with a silver amplification solution showed highly selective hybridization to complementary array elements. Redundant spots of the same capture sequence showed reproducible and consistent hybridization signal. No background adsorption by nanoparticles or silver stain was observed. The darker spots corresponding to adenine at position 8 indicate that oligonucleotide target hybridized preferentially to perfectly complementary capture strands over mismatched ones by a more than 3:1 ratio. In comparison, fluorophore labels only provided 2:1 selectivity for adenine at position 8. Nanoparticle labeled probes were significantly more sensitive than those using fluorophore labeled probes. Hybridization signal could be resolved at target concentrations as low as 50 fM in comparison to Cy3/Cy5 fluorophore labeled arrays for which 1 pM or greater target concentrations are required.

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